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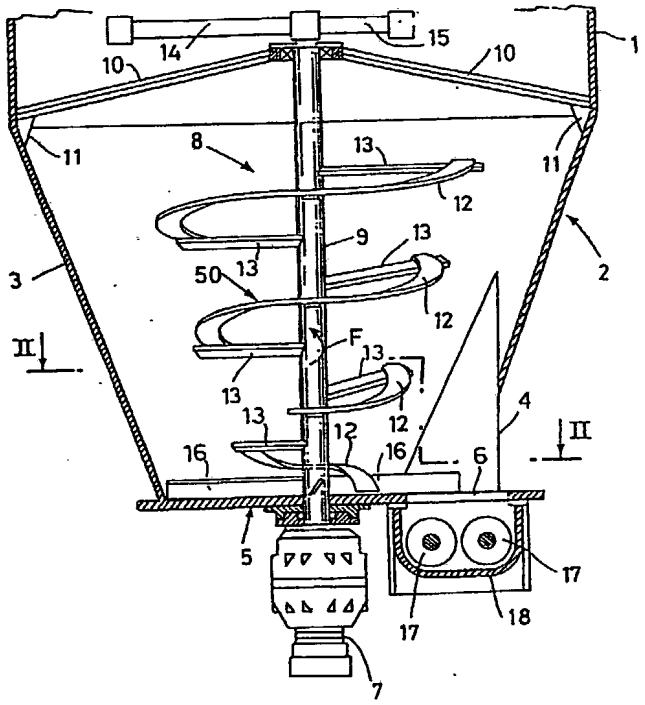

(57) Abstract

A conical-bottom (2) silo, particularly suitable for small-sized plastic material with properties of high elasticity, comprises a conical screw stirrer (8) inserted axially in the conical bottom (2) of the silo. The conical screw (12) of the stirrer (8) is discontinuous and divided into several sections. Moreover the silo has means of discharging the material arranged below an outlet port positioned laterally in relation to said stirrer and consisting of two co-operating cylindrical screws (17).

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SILO WITH CONICAL STIRRER SCREW FOR ELASTIC GRANULES

* * * *

D E S C R I P T I O N

The present invention relates to a conical-bottom silo which is particularly, albeit not solely, suitable for small-sized plastic material and rubber with characteristics of high elasticity as in the case of plastics of the "stretch" type (LLPE, linear, low, polyethylene).

Silos for small-sized plastic material are already known, such as the silo described in the Italian patent no. 1078053. This patent relates to a conical-bottom silo with a conical screw stirrer inserted axially in the conical bottom of the silo and a cylindrical screw delivery and outlet part situated at an outlet port arranged laterally in relation to the stirrer at the lower end of the conical bottom of the silo itself.

A silo of this type functions perfectly for the various kinds of small-sized plastic material except in the case wherein particularly elastic plastics and rubber are being dealt with. With a material having these properties areas of compression can in fact form in the conical bottom of the silo due to the action performed by the stirrer. Blocks of materials, which prevent the conical screw and the relative motor from moving, are then created in these areas. As a result thereof there is discontinuity of operations and feed (metering) of the material during delivery and strong mechanical stress of the screw with subsequent damage thereto and possible breakage of the motor.

The main object of the present invention is therefore to provide a conical-bottom silo with a conical screw stirrer,

particularly suitable for plastic materials and rubber with high elasticity.

In accordance with the invention the main object is achieved by means of a conical-bottom silo with a conical screw stirrer inserted axially in the conical bottom of the silo, characterised in that the conical screw of the stirrer is discontinuous and divided into several sections.

The use of a thus discontinous conical screw allows the action of compression on the material, which occurs during the movement of the stirrer itself, to be released: the divisions of the screw, enabling the material to expand, in fact prevent the formation of compressed blocks of material inside the lower conical body of the silo.

The features of the present invention will be made clearer by the following detailed description of its possible embodiments, shown by way of a non-limitative example in the accompanying drawings, in which:

Fig. 1 shows in an axial section the lower part of a silo according to the invention with a discontinuous conical screw mounted on leaf springs;

Fig. 2 shows said lower part of the silo sectioned transversely along line II-II of Fig. 1;

Fig. 3 shows the outlet part of the silo in section along line III-III of Fig. 2;

Fig. 4 show in axial section the lower part of a silo according to the invention with the discontinuous conical screw mounted on a double truncated cone support;

Fig. 5 shows said lower part of the silo sectioned transversely along line V-V of Fig. 4;

Fig. 6 shows in axial section the lower part of a silo

according to the invention with the discontinuous conical screw mounted on a double truncated cone support and with means for the forced supply of air;

Fig. 7 shows said lower part of the silo sectioned transversely along line VII-VII of Fig. 6.

The silo illustrated in Figs. 1 and 2 essentially comprises a cylindrical wall 1 which extends axially for almost all the vertical extension of the silo, with the exception of a bottom part 2 provided with a conical wall 3 ending below with a squared portion 4.

A plate 5 provided with a rectangular aperture 6 displaced laterally towards said squared wall 4 closes off the conical bottom 2 of the silo and supports in a central position, that is to say along the axis of the conical wall 3 and of the cylindrical wall 1 above, a motor 7 for rotating a discontinuous conical screw stirrer 8 inserted in the conical base 2.

Said stirrer comprises a central shaft 9 supported by the motor 7 and maintained in a perfect axial position by three arms 10 (only two are shown in Fig. 1) arranged at 120° one in respect of the other and attached by means of small plates 11 to the area where the walls 1 and 3 join. Around said shaft 9 extends a conical screw 50 which is discontinuous and divided into several sections 12, each of which is attached to the shaft itself by means of elastic leaf spring arms 13 in a number varying according to the extension of the section 12.

Two blades 14 and 15 of different radius are also attached to the top of the shaft 9 to maintain stirring of the material above the arms 10.

At the base of the shaft 9, at the plate 5, there are four

blades 16 of equal length directly connected to the shaft itself and arranged at 90° one to the other.

Finally, below the plate 5, at the rectangular aperture 6, a double cylindrical delivery screw 17 is transversely arranged and rotatably supported by a cylindrical casing 18 provided with an inlet mouth 19 and an outlet mouth 20 and which is rotated by a pair of motors 21 (Figs. 2 and 3).

During operation, the motor 7 rotates, in the direction indicated by the arrow F in Fig. 1, the discontinuous conical screw 8, which causes a slow rising movement of the material which is placed inside the conical development defined by the discontinuous screw 12.

The material itself then falls through gravity along the conical wall 3, producing an output flow at a constant flow rate through the outlet port 6. The constant flow rate is ensured by the non-compressed state of the material in the conical part 2 due to the stirring created by the part 8 and by the support action performed by the arms 10 on the material above the cylindrical part.

In the event of any phenomena of compression in the material at the subsequent section of screw 12, the fact that the screw 50 is not continuous enables subsequent decompression of the material; moreover, when blocks of material form, elastic deformation of the leaf springs 13 and of the nearest sections of screw 12 also occurs so as to contribute to an immediate decompression of the material itself and prevent permanent deformations of the stirrer 8.

The task of the four blades 16 at the base of the shaft 9 is to scrape the plate 5 to facilitate discharge of the material accumulated on the base of the silo through the outlet port 6.

As far as the output and delivery of the plastic material are concerned, the double horizontal cylindrical screw 17 conveys the material to the centre of the delivery part and transports it towards the outlet mouth 20, avoiding phenomena of friction of the material against the fixed wall 18 and thus guaranteeing an even and continuous discharge of material.

The silo described in Figs. 4 and 5 differs from that described in Figs. 1, 2 and 3 only as regards the support of the discontinuous conical screw 50.

The stirrer 22, inserted in the conical bottom 2, also comprises a central shaft 9 supported by the motor 7. However said central shaft is this time integral with two truncated cones 23 and 24, hollow internally and matching at their largest base. The sections of the discontinuous conical screw 12 are located on the external wall of the lower truncated cone 24.

The blades 16 are inserted, in this case, at the base of the lower truncated cone 24 at the plate 5 (Figs. 4 and 5).

The two truncated cones 23 and 24 make the structure of the stirrer 22 stronger and facilitate operations for cleaning it.

Figs. 6 and 7 show a variant of the silo of Figs. 4 and 5 in which, in addition to the devices described previously, an air filter 25, a fan 26 with a motor 51 and a hollow ring 27, placed axially below the plate 5, are provided. The plate 5 has, in turn, at the hollow ring 27 and the base of the lower truncated cone 24, six apertures 28 and, to conclude, the side wall of the truncated cone 24 is provided with grating-covered rectangular apertures 29 below the screw sections 12.

The air filtered by the filter 25 and compressed by the fan 26 is emitted, through the hollow ring 27 and the apertures 28

of the plate 5, into the internal cavity of the two truncated cones 23 and 24 and from which it is released, through the grating-covered apertures 28, into the cavity of the bottom part 2 of the silo.

The emission of filtered air has a fluidification effect on the material, which facilitates its discharge, and the detachment of the same material from the external wall of the lower truncated cone 24.

In the event of use of hot air, there is also a drying effect on the material such that the silo can be used as a dryer.

C L A I M S

1. Conical-bottom silo, particularly suitable for small-sized plastic material and rubber with high elasticity properties, with a stirrer (8) with a conical screw (50) inserted axially in the conical bottom of the silo, characterised in that the conical screw (50) of the stirrer (8) is discontinuous and divided into several sections (12).

2. Silo according to claim 1, characterised in that it has the discontinuous conical screw (50) mounted on elastic arms (13).

3. Silo according to claim 1, characterised in that the discontinuous conical screw (50) is inserted on a double truncated cone support (22).

4. Silo according to claim 3, characterised in that said double truncated cone support (22) has means (25, 26, 27, 51) for the forced supply of air inside said support (22) and grating-covered apertures (29) in the wall of said support (22) for the release of air from said support (22) towards the interior of the silo.

5. Silo according to claim 4, characterised in that the air emitted by forced supply means (25, 26, 27, 51) is hot air.

6. Silo according to claim 1, characterised in that it comprises means (17 and 18) for discharging the material arranged below an outlet port (6) of the silo, placed laterally in relation to said stirrer (8) and consisting of two co-operating parallel screws (17).

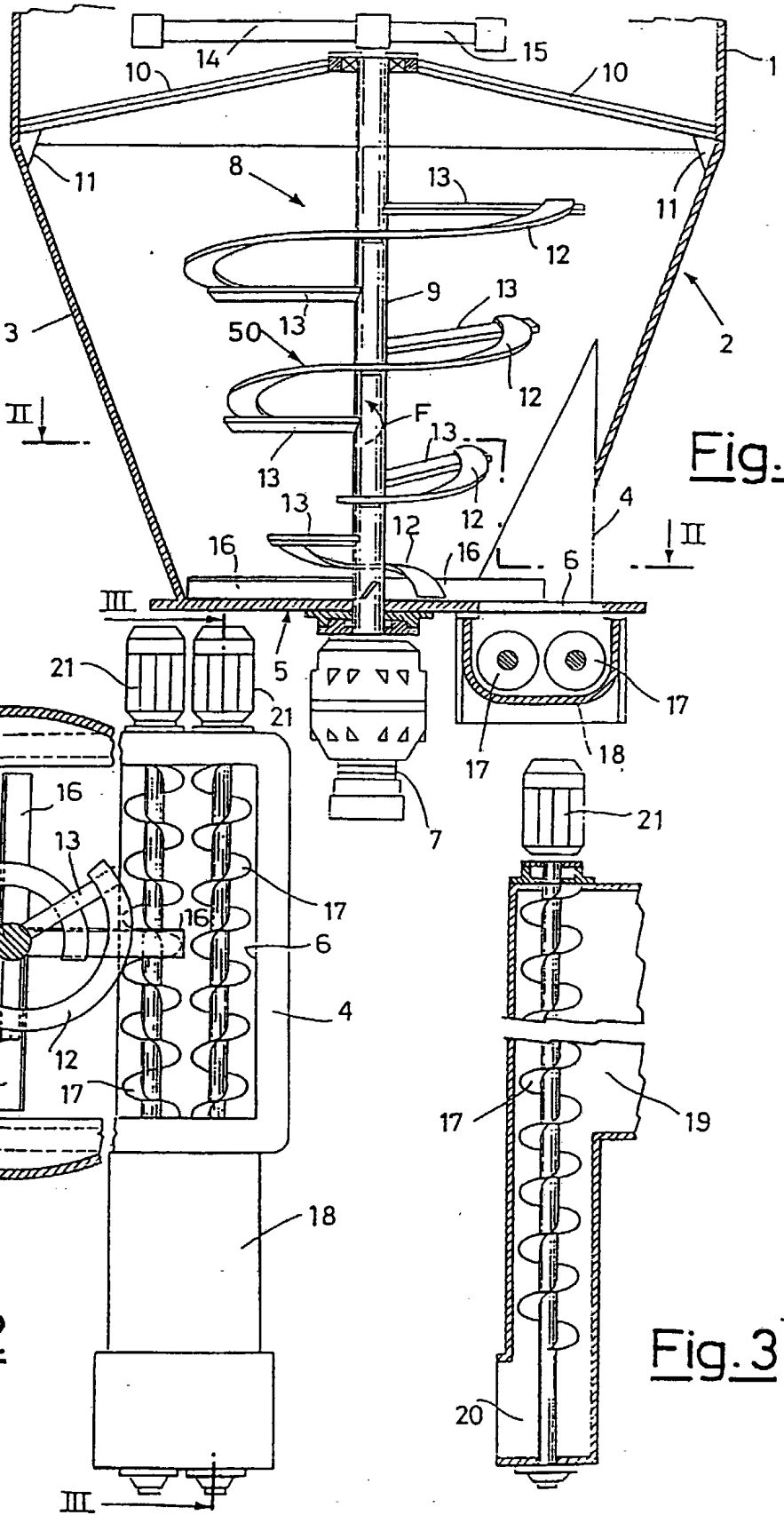

Fig.1

Fig.2

Fig.3

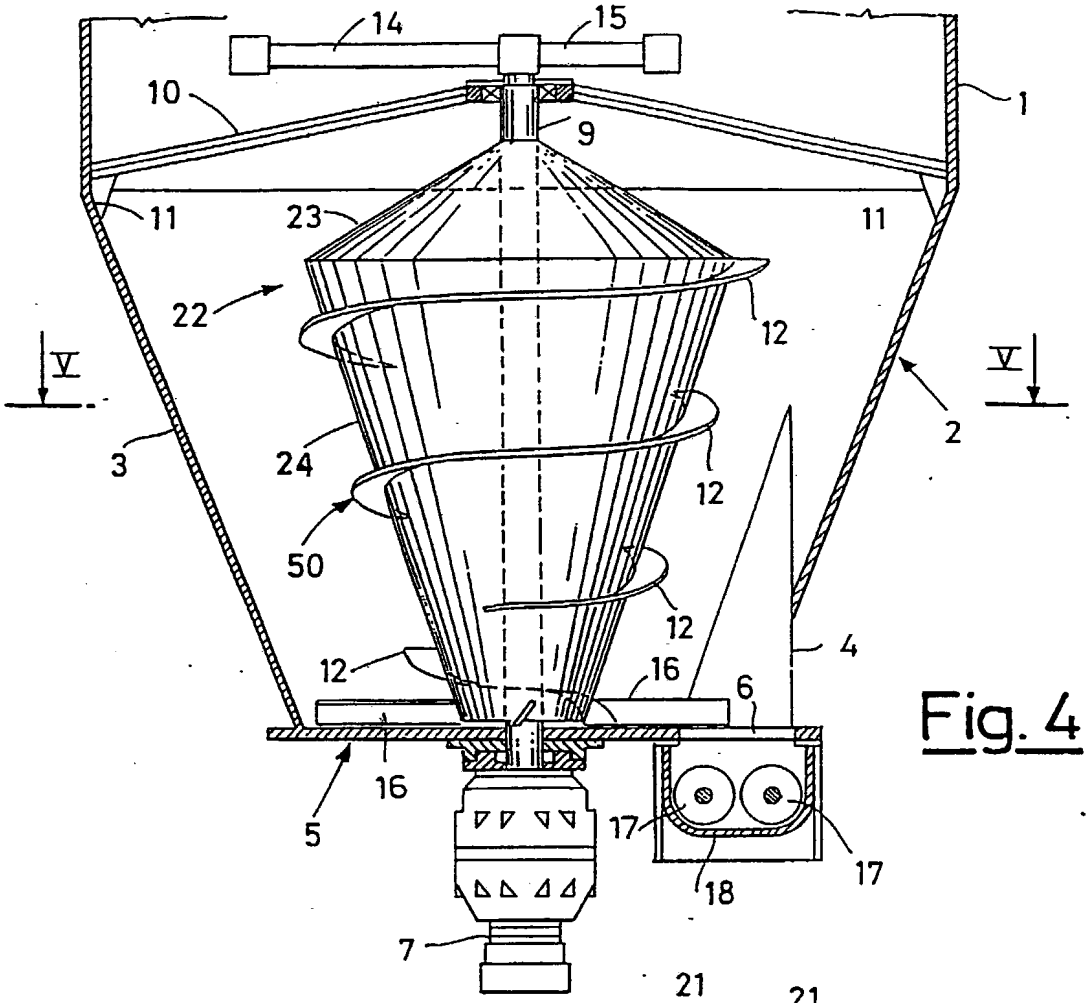
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Fig. 4

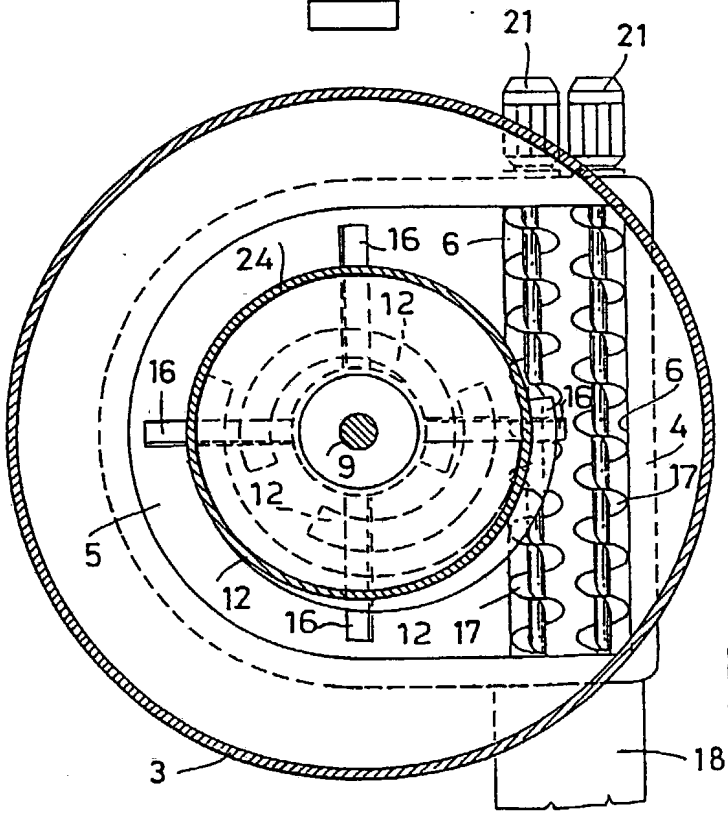
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Fig. 5

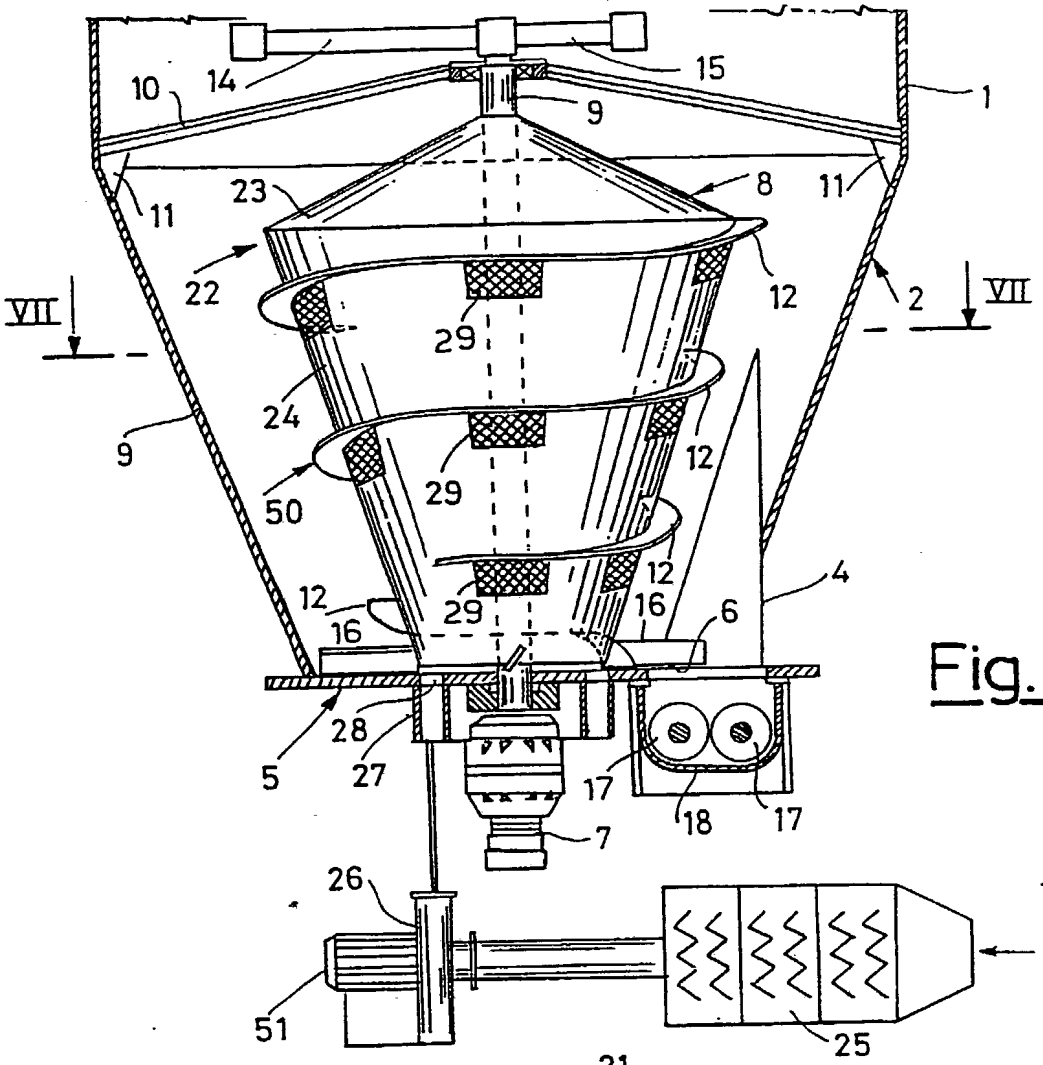
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Fig. 6

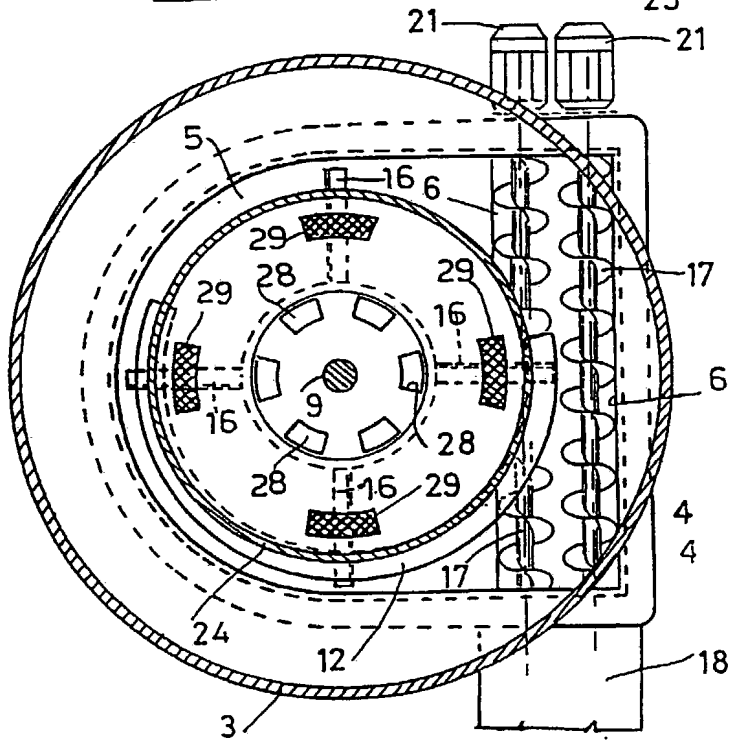
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Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No PCT/EP 93/00713

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B01F15/00; B01F13/02

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	B01F ; B29B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category[10]	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X A	FR,A,1 572 753 (ASTRA NUTRITION AB) 27 June 1969 see page 5, line 39 - page 6, line 12; figure 1	1-2 4-6
A	US,A,4 185 925 (GAZZONI) 29 January 1980 cited in the application	1-6
A	PATENT ABSTRACTS OF JAPAN vol. 013, no. 237 (M-833)5 June 1989 & JP,A,10 49 605 (MATSUI SEISAKUSHO KK) see abstract; figure	1,3-5
A	DE,A,1 941 163 (CHEMISCHE WERKE ALBERT) 25 February 1971 see page 4, last paragraph; figure	1,4-5

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IV. CERTIFICATION

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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	MODERN PLASTICS INTERNATIONAL vol. 12, no. 12, December 1982, LAUSANNE CH page 65 WERNER & PFLEIDERER MASCHINENFABRIK 'unit drys materials while on conveyors'	1,4-5

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

EP 9300713
SA 73205

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		NL-A- 6809233	31-12-68
		US-A- 3646688	07-03-72
US-A-4185925	29-01-80	None	
DE-A-1941163	25-02-71	None	